

1 WE CLAIM:

1 1. A disk drive comprising:

2 (a) a disk comprising a plurality of tracks, each track comprising a plurality of data
3 sectors;

4 (b) a head actuated radially over the disk, the head for generating a read signal while
5 reading data from at least one of the data sectors;

6 (c) a buffer for buffering read data associated with the read signal;

7 (d) a disk controller for processing a read command received from a host computer by:
8 positioning the head over a selected data sector to generate a first read signal;
9 storing in the buffer first read data associated with the first read signal;
10 if a read error occurs:
11 repositioning the head over the selected data sector to generate a second read
12 signal;
13 averaging second read data associated with the second read signal with the first
14 read data stored in the buffer to generate averaged read data;
15 storing the averaged read data in the buffer; and
16 processing the averaged read data stored in the buffer to recover the selected data
17 sector.

1 2. The disk drive as recited in claim 1, wherein the read data comprises binary bits detected
2 from the read signal such that the averaged read data comprises averaged binary bits.

1 3. The disk drive as recited in claim 2, wherein the disk controller implements an error
2 correction code (ECC) for detecting and correcting errors in the averaged binary bits.

1 4. The disk drive as recited in claim 3, wherein:
2 (a) the averaged binary bits are grouped into ECC symbols;
3 (b) a reliability metric is generated for each ECC symbol in response to a reliability
4 derived from averaging the binary bits; and
5 (c) the disk controller processes the reliability metrics to augment the ECC.

1 5. The disk drive as recited in claim 4, wherein:

2 (a) at least one erasure pointer is generated from the reliability metrics; and

3 (b) the disk controller processes the erasure pointer to increase the number of correctable

4 ECC symbols.

1 6. The disk drive as recited in claim 1, wherein the read data comprises read signal sample

2 values generated by sampling the read signal such that the averaged read data comprises

3 averaged read signal sample values.

1 7. The disk drive as recited in claim 6, further comprising a read channel for detecting an

2 estimated data sequence from the averaged read signal sample values.

1 8. The disk drive as recited in claim 7, wherein the read channel comprises:

2 (a) an equalizer filter for filtering the averaged read signal sample values to generate

3 equalized read signal sample values; and

4 (b) a sequence detector for detecting the estimated data sequence from the equalized read

5 signal sample values.

1 9. The disk drive as recited in claim 1, wherein the disk controller adjusts at least one

2 parameter of the disk drive prior to rereading the selected data sector.

1 10. The disk drive as recited in claim 9, wherein the disk controller adjusts a read channel

2 parameter.

1 11. The disk drive as recited in claim 9, wherein the disk controller adjusts a servo control

2 parameter.

1 12. The disk drive as recited in claim 11, wherein the disk controller adjusts a tracking offset

2 to at least two different settings wherein for each tracking offset setting the disk controller

3 performs at least one reread of the selected data sector to generate the averaged read data.

1 13. The disk drive as recited in claim 12, wherein for each tracking offset setting the disk

2 controller performs multiple rereads of the selected data sector to generate the averaged

3 read data.

1 14. A method of recovering an errant data sector in a disk drive, the disk drive comprising a
2 disk having a plurality of tracks, each track comprising a plurality of data sectors, a head
3 actuated radially over the disk, the head for generating a read signal while reading data
4 from at least one of the data sectors, and a buffer for buffering read data associated with
5 the read signal, the method comprising the steps of:
6 (a) receiving a read command from a host computer;
7 (b) positioning the head over a selected data sector to generate a first read signal;
8 (c) storing in the buffer first read data associated with the first read signal;
9 if a read error occurs:
10 (d) repositioning the head over the selected data sector to generate a second read
11 signal;
12 (e) averaging second read data associated with the second read signal with the first
13 read data stored in the buffer to generate averaged read data;
14 (f) storing the averaged read data in the buffer; and
15 (g) processing the averaged read data stored in the buffer to recover the selected data
16 sector.

1 15. The method as recited in claim 14, wherein the read data comprises binary bits detected
2 from the read signal such that the averaged read data comprises averaged binary bits.

1 16. The method as recited in claim 15, further comprising the step of using an error
2 correction code (ECC) for detecting and correcting errors in the averaged binary bits.

1 17. The method as recited in claim 16, further comprising the steps of:
2 (a) grouping the averaged binary bits into ECC symbols;
3 (b) generating a reliability metric for each ECC symbol in response to a reliability
4 derived from averaging the binary bits; and
5 (c) processing the reliability metrics to detect and correct errors in the averaged binary
6 data.

1 18. The method as recited in claim 17, further comprising the steps of:
2 (a) generating at least one erasure from the reliability metrics; and
3 (b) processing the erasure pointer to increase the number of correctable ECC symbols.

1 19. The method as recited in claim 14, wherein the read data comprises read signal sample
2 values generated by sampling the read signal such that the averaged read data comprises
3 averaged read signal sample values.

1 20. The method as recited in claim 19, further comprising the step of detecting an estimated
2 data sequence from the averaged read signal sample values.

1 21. The method as recited in claim 20, further comprising the steps of:
2 (a) filtering the averaged read signal sample values to generated equalized read signal
3 sample values; and
4 (b) detecting the estimated data sequence from the equalized read signal sample values.

1 22. The method as recited in claim 14, further comprising the step of adjusting at least one
2 parameter of the disk drive prior to rereading the selected data sector.

1 23. The method as recited in claim 22, wherein the step of adjusting a parameter of the disk
2 drive comprises the step of adjusting a read channel parameter.

1 24. The method as recited in claim 22, wherein the step of adjusting a parameter of the disk
2 drive comprises the step of adjusting a servo control parameter.

1 25. The method as recited in claim 24, further comprising the steps of adjusting a tracking
2 offset to at least two different settings wherein for each tracking offset setting rereading
3 the selected data sector at least once to generate the averaged read data.

1 26. The method as recited in claim 25, wherein for each tracking offset setting rereading the
2 selected data sector multiple times to generate the averaged read data.

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